

SCRATCH-RESISTANT COATING FOR A SEMICONDUCTOR COMPONENT

5 Cross-Reference to Related Application:

This application is a continuation of copending International Application No. PCT/DE00/02568, filed August 2, 2000, which designated the United States.

Background of the Invention:

Field of the Invention:

The present invention relates to a scratch-resistant coating for a semiconductor component, which in particular can be used as the supporting surface for measuring fingerprints.

Semiconductor components that are exposed to environmental influences, and in particular, to mechanical wear require a particularly hard, scratch-resistant passivation. In fingerprint sensors, the finger pad is rested on a supporting surface. In this manner, the supporting surface is exposed to mechanical wear that significantly impairs the properties of the fingerprint sensor. With fingerprint sensors that operate according to the capacitive measurement method, it is important to keep the distance, between a resting finger pad and the conductor planes in the semiconductor component of the sensor, constant within a narrow tolerance even after the

sensor has been used for a relatively long time. Conventional passivation layers made of silicon oxide or silicon nitride, such as those that are usually used in semiconductor technology, cannot be suitably used when the surface of the component is subjected to relatively great loading. Using thicker passivation layers or customary passivation materials such as polyimide, for example, is not suitable, since thicker passivations reduce the sensitivity of the sensor.

Testing that has been performed on fingerprint sensors that have been passivated with customary passivation layers has shown that the finger supporting surface of such sensors is required to have a high scratch resistance.

#### Summary of the Invention:

It is accordingly an object of the invention to provide a semiconductor component having a surface coating which overcomes the above-mentioned disadvantages of the prior art apparatus of this general type.

In particular, it is an object of the invention to provide a coating for a semiconductor component which, even when the coating has a small layer thickness and even when the coating is subjected to high loading, is sufficiently hard and scratch-resistant to be used in fingerprint sensors.

With the foregoing and other objects in view there is provided, in accordance with the invention, a semiconductor component including a surface coating formed as an antifrictional layer for providing protection against scratches and mechanical abrasion. The antifrictional layer is formed from a combination of materials including fats, oils, surfactants, and waxes. The antifrictional layer has an upper side forming a supporting surface of a fingerprint sensor for sensing a finger pad.

In accordance with an added feature of the invention, the antifrictional layer contains a silicone oil.

In accordance with an additional feature of the invention, the antifrictional layer contains a perfluoropolyether.

With the foregoing and other objects in view there is also provided, in accordance with the invention, a surface coating formed as an antifrictional layer. The antifrictional layer is an emulsion including water, paraffin oil, propylene glycol, stearic acid, palmitic acid, triethylamine, beeswax, carbomer 954, methylparaben and propylparaben. In accordance with added features of the invention, there is provided, a passivation layer having an upper side; the passivation layer is either a polyimide layer, a silicon oxide layer, a silicon nitride layer, or a double layer having a silicon oxide layer and a

silicon nitride layer. The antifrictional layer protects the upper side of the passivation layer against scratches and mechanical abrasion. The antifrictional layer has an upper side forming a supporting surface of a fingerprint sensor provided for sensing a finger pad.

The coating is based on the realization that scratches on a passivation layer are caused by shearing forces that act on the surface. The coating according to the invention is an antifrictional layer, which has the property of reducing such shearing forces to such an extent that damage to the surface is prevented, and if used as intended, wear is greatly reduced. Since this antifrictional layer can be applied very thinly, when it is used, the sensitivity of the capacitively measuring sensor is not reduced. This antifrictional layer is preferably applied to a customary passivation layer of an oxide and/or a nitride.

Other features which are considered as characteristic for the invention are set forth in the appended claims.

Although the invention is illustrated and described herein as embodied in a scratch-resistant coating for semiconductor components, it is nevertheless not intended to be limited to the details shown, since various modifications and structural changes may be made therein without departing from the spirit

of the invention and within the scope and range of equivalents of the claims.

The construction and method of operation of the invention,  
5 however, together with additional objects and advantages thereof will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

Brief Description of the Drawing:

The sole drawing figure is a cross sectional view of the layers of a capacitively measuring sensor on semiconductor material.

Description of the Preferred Embodiments:

Referring now to the sole figure of the drawing in detail,  
there is shown a conductor layer 1 that is located on the upper side of a semiconductor component 2. The figure only shows a portion of the semiconductor component 2, which is  
20 illustrated without a specific structure. The conductor layer 1, for example, when constructed as part of a fingerprint sensor, may be divided into a multiplicity of conductor areas arranged in a grid form and corresponding to image points. The conductor layer 1 is covered with a passivation layer 3, which  
25 may be, for example, polyimide or a single or double layer of silicon oxide and/or silicon nitride. This passivation layer 3

ensures that the conductor layer 1 is electrically insulated, mechanically protected and kept at a constant distance from the outer surface of the component. To protect the upper side of the passivation layer 3 from scratches and mechanical abrasion, according to the invention, the antifrictional layer 4 is applied. The surface of the antifrictional layer 4, for example, in the case of a fingerprint sensor, represents the supporting surface 5 for a finger pad.

Fats, oils, boundary-/surface-active substances (surfactants) and/or waxes preferably come into consideration as the material for the antifrictional layer. If the antifrictional layer will be applied before the component is fitted into a housing, it is generally necessary to resort to more temperature-resistant materials for the antifrictional layer, because of the greater exposure to high temperatures. These may be, inter alia, synthetic oils or fats (for example silicone oil) or synthetic waxes (for example Teflon wax) or thin layers of a material of the polytetrafluoroethylene group (for example TEFLON<sup>™</sup>). In the substance group of surfactants, perfluoropolyethers exhibit very good mechanical stability and chemical resistance. In a particularly preferred exemplary embodiment of the antifrictional layer according to the invention, it is formed by an emulsion comprising: water, paraffin oil, propylene glycol, stearic acid, palmitic acid,

TEA (triethylamine), beeswax, carbomer 954, methylparaben and propylparaben. Perfume can be added without any concern.

10067176-020402